MONTHLY WEATHER REVIEW.

WASHINGTON, D. C., DECEMBER, 1882.

INTRODUCTION.

This REVIEW presents a general summary of the meteorological conditions which prevailed over the United States and adjoining territories during the month of December, 1882, and a brief description of the storms occurring in the north Atlantic ocean, as determined from reports of observations taken at 7.00, Washington mean time, and received at this office up to January 20th.

The most marked features of the month have been:

1st.—The low temperature which occurred in the Southern states, especially at stations on the Gulf coast and in Florida, the average being 3° below the mean of December. The low temperature was, in a great measure, due to the cold wave of the 15th, 16th, and 17th, during the continuance of which killing frosts occurred as far south as central Florida. Information of its advance was telegraphed from this office to the sugar and fruit regions of the south, and the Signal Service observers report that the timely warnings thus given were worth thousands of dollars to the sugar interests.

2d.—The high mean temperature which prevailed in the Rocky mountain region. Generally, the month was colder than the mean of December, east of the Rocky mountains, and warmer than the mean in that region, and thence westward to the Pacific coast. The only exception to this occurred in the lower Missouri valley, where the temperature averaged 0°.5 above the mean for the month.

3d.—The rainfall of the month was generally below the December average, except in the lake region, the south Atlantic states, the Florida peninsula, and in the north Pacific region. In the last-mentioned district, the excess was unusually large; at Portland, Oregon, the rainfall reached the unprecedented amount of 20.14 inches, and destructive floods occurred in that vicinity. In the middle Pacific coast region, the deficiency was equally marked.

That part of the REVIEW referring to International Meteorology presents the general weather conditions which prevailed over the northern hemisphere during the month of October, 1880. The prominent meteorological feature of the month was the unusually low temperature that prevailed in Europe,—the month having been one of the coldest Octobers on record, (see NOTES and EXTRACTS.) The October rainfall, in Europe, was also very much in excess of the average; in central and western Europe the monthly rainfall being more than double the October average. In the United States, the weather conditions differed but slightly from the normal. Chart v. exhibits the paths of barometric minima during January, 1881. The depression charted as low-area xxi. is especially noteworthy on account of the phenomenally heavy snowfalls that accompanied it in Europe.

In the preparation of this REVIEW, the following data received up to Janurry 20th, have been used; viz.: the regular tri-daily weather charts, containing the data of simultaneous observations taken at one hundred and thirty-six Signal Service stations and fourteen Canadian stations, as telegraphed to this office; one hundred and eighty-eight monthly journals, and one hundred and eighty monthly means from the former, and fourteen monthly means from the latter; two hundred and sixteen monthly registers from voluntary observers; fifty-two monthly registers from United States Army Post Surgeons; Marine Records; International Simultaneous Observations; Marine Reports, through the co-operation of the "New York Herald Weather Service;" abstracts of Ships' Logs, furnished by the publishers of "The New York Maritime Register;" monthly reports from the local weather services of Indiana, Kansas, Nebraska, and Missouri, and of the Central Pacific railway company; extracts from the Iowa Weather Bulletin for December, 1882; trustworthy newspaper extracts; and special reports.

BAROMETRIC PRESSURE.

[*Expressed in inches and hundredths.*]

The mean barometric pressure for the month of December, 1882, over the United States and Canada, is shown by the isobarometric lines (in black) on chart ii.

The region of greatest mean pressure occupies an area extending from Oregon and Nevada eastward and northeastward to the Missouri valley and the extreme northwest, and is inclosed by the isobar of 30.25. The highest monthly mean pressures reported are, Salt Lake City, Utah, and Fort Buford, Dakota, 30.27; and Pike's Peak, Colorado, 30.28. The isobar of 30.15 incloses nearly the whole of the United States west of the ninety-fifth meridian, and also a large area extending eastward of that meridian to the Atlantic, and from the Gulf of Mexico northward to the fortieth parallel. From the region of highest mean pressure, the monthly means decrease to 30.1 at Portland, in the north Pacific coast region; and to 30.04 and 30.06 at Yuma and San Diego, respectively, in the south Pacific coast region. An area of low mean pressure covers the Canadian Maritime Provinces and New England. The lowest monthly means reported are, Sydney, Nova Scotia, 29.86; Charlottetown, Prince Edward Island, 29.90, and Halifax, Nova Scotia, 29.94.

Compared with the means of the previous month, the pressure is from 0.01 to 0.04 higher in the south Atlantic states and in Florida; in the extreme northwest and in the upper Missouri valley, there is an increase of from 0.01 to 0.06; on the Pacific coast from Visalia, California, to Roseburg, Oregon, there is an increase varying from 0.01 to 0.09. In all other districts, the pressure is lower. In New England, the decrease varies from 0.05 to 0.12; in the lake region, from 0.02 to 0.12; in the middle slope, from 0.05 to 0.16; elsewhere the decrease is less marked.

DEPARTURES FROM THE NORMAL VALUES FOR THE MONTH.

Compared with the means of previous years, no marked departures have occurred. In the middle and south Atlantic states, Tennessee and the Ohio valley, there has been a slight increase varying from normal to 0.03 above. From New England westward to the Mississippi river, the pressure is from normal to 0.06 below. From the Mississippi westward to the Pacific coast, the departures are from normal to 0.08 above, except at stations in southern California, and on the west Gulf coast, where the pressure is slightly below the normal.

BAROMETRIC RANGES.

The barometric ranges have varied from 0.50 to 1.54, the smallest being reported from Tucson, Arizona, and the greatest from Saint Louis, Missouri. In the several districts the ranges have been as follows:

New England.—From 0.91 at Block Island and Narragansett Pier, Rhode Island, to 1.18 at Portland, Maine and Mount Washington, New Hampshire.

Middle Atlantic states.—From 0.81 at New York City, to 0.99 at Albany, New York.

South Atlantic states.—From 0.75 at Atlanta, Georgia, to 0.95 at Hatteras, North Carolina.

Florida peninsula.—From 0.57 at Key West, to 0.78 at Cedar Keys.

Eastern Gulf states.—From 0.88 at Montgomery, Alabama and Pensacola, Florida, to 1.10 at Starkville, and 1.12 at Vicksburg, Mississippi.

Western Gulf states.—From 0.88 at Port Eads, Louisiana and 0.98 at Galveston, Texas, to 1.50 at Little Rock and 1.53 at Fort Smith, Arkansas.

Ohio valley and Tennessee.—From 0.86 at Chattanooga and Knoxville, Tennessee, to 1.32 at Champaign, Illinois.

Lower lake region.—From 0.81 at Detroit, Michigan, to 0.98 at Oswego, New York.

Upper lake region.—From 0.88 at Port Huron, Michigan, to 1.16 at Chicago, Illinois, and 1.18 at Duluth, Minnesota.

Extreme northwest.—From 1.14 at Saint Vincent, Minnesota, to 1.34 at Fort Stevenson and 1.35 at Bismarck, Dakota.

Upper Mississippi valley.—From 1.09 at Madison, Wisconsin, to 1.54 at Saint Louis, Missouri.

Missouri valley.—From 1.23 at Yankton, Dakota, to 1.52 at Leavenworth, Kansas.

Northern slope.—From 0.83 at Cheyenne, Wyoming, to 1.35 at Fort Assinniboine, and 1.37 at Fort Keogh, Montana.

Middle slope.—From 0.78 at Pike's Peak, Colorado, to 1.10 at West Las Animas, Colorado, and 1.12 at Fort Elliott, Texas.

Southern slope.—From 0.69 at Fort Davis, and 0.93 at Fort Stockton, Texas, to 1.35 at Fort Sill, Indian Territory.

Southern plateau.—From 0.50 at Tucson and 0.51 at Fort Grant, Arizona, to 0.67 at Prescott, Arizona, and 0.85 at Santa Fé, New Mexico.

Middle plateau.—From 0.88 at Pioche, Nevada, to 0.98 at Salt Lake City, Utah.

Northern plateau.—From 0.95 at Eagle Rock, Idaho, to 1.06 at Umatilla, Oregon, and 1.10 at Lewiston, Idaho.

Middle Pacific coast region.—From 0.60 at San Francisco, California, to 0.72 at Red Bluff, California.

Southern Pacific coast region.—From 0.46 at Los Angeles, California, to 0.56 at Visalia, California, and 0.63 at Yuma, Arizona.

AREAS OF HIGH-PRESSURE.

Seven areas of high barometer passed over the region east of the Rocky mountains during the month; two of them first appeared on the Pacific coast. The general direction of movement of these areas was to the southeast, until the area of greatest pressure reached the Atlantic coast, where, in some cases, the direction of the movement changed to the northeast; then it followed the general direction of the coast-line, as the pressure increased to the northward at stations near the Atlantic coast. High-area vii. apparently disappeared within the limits of the stations of observation. This area extended over the Saint Lawrence valley and adjoining districts where the pressure decreased rapidly, unattended by the usual increase of pressure at stations to the eastward of this region.

I.—The 7.00 a. m. weather map of the 1st, exhibited an extended area of high barometer covering the plateau regions, where the pressure ranged from 0.2 to 0.4 above the normal, the greatest pressure being over Nevada and Utah, where the barometer, reduced to sea-level, ranged above 30.5. The movement of this area during the 1st, was directly to the eastward, and, on the morning of the 2d, the pressure had increased to 30.6 on the eastern slope of the Rocky mountains. After passing to the east of the mountains, the course changed and the barometer gradually rose to 30.4, and above in the southwest. The region inclosed by the highest isobar, became elongated in the direction of the Atlantic coast-line, and this area disappeared on the 4th, when the pressure was greatest on the middle Atlantic and New England coasts, thus indicating a general movement slightly to the north of east after the area of greatest pressure passed over the Atlantic.

II.—This area was first observed on the 5th, advancing from the regions north of the Missouri valley, and on the morning of the 6th, snow had fallen at all the northern stations west of Minnesota, attended by temperatures ranging from 5° above to 14° below zero, and by barometric pressures ranging from 30.6 to 30.8 in Montana. At the midnight report of this date, this area became well defined as a cold wave advancing towards the districts east of the Mississippi. At this report the barometer ranged from 30.88 to 30.96 in Nebraska, Dakota, and western parts of Iowa and Minnesota. The barometric gradient was marked to the east and south of the regions above named, and at stations in northern Texas, the temperatures fell from 50° to 60° in less than sixteen hours. On the afternoon of the 6th, the Chief Signal Officer notified the Sugar Growers' Association at New Orleans, and, by special message to the local authorities, all railroads operated in the southwest, that this cold wave was advancing toward that section, and warned them that freezing weather would probably extend as far southward as the Gulf coast. On the afternoon of the 7th, this area was central in eastern Kansas, where the barometer had risen to 30.91 at Leavenworth. Professor F. H. Snow states in his report that the barometer at his station, Lawrence, Kansas, was more than 0.2 higher on that day than it has previously been during the fifteen years of his record. The general telegraphic reports indicated the advance of a barometric depression in the Rocky mountain region, and the gradient was rapid in all directions from the lower Missouri valley. A severe norther occurred on the Gulf coast, the wind reaching a velocity of fifty-nine miles per hour at Indianola, forty-eight miles at Galveston, and forty-three miles at Port Eads, on the 7th. Northwest gales also occurred on the northern lakes attended by snow, which was soon followed by clearing cold weather; the temperature falling to zero as far south as the Ohio valley on the 8th. This area was central near Cairo on the 8th, and by midnight of that date it had passed to the middle Atlantic coast, where the pressure ranged from 30.42 to 30.55, or about 0.4 lower than the barometer was when this area was central in the interior of the continent. During the transit of this cold wave over the United States, the temperature fell below freezing at New Orleans, Pensacola, and Savannah; and killing frosts occurred in Louisiana. When last observed the reports indicated the movement almost directly east from the Atlantic coast.

III.—This area advanced from the north Pacific coast on the 9th, slowly extending over the Rocky mountain region, and moving in a southeasterly direction over Nevada, Utah, Colorado, New Mexico, and Texas; the barometer ranging from 30.3 to 30.4 near the centre. On the morning of the 11th, it extended over the southwest, and from that region it gradually extended over the Southern states during the 12th, attended by clear weather. This area, as in the case of i., extended to the northward after reaching the coast, and the course in this case changed to the northeast, the centre passing along the Atlantic coast until it reached latitude 45° N., where it disappeared to the eastward on the 13th.

IV.—This area appeared in British America north of the upper Missouri valley on the 13th, the region of high barometer extending to the southwestward over the Rocky mountain stations, Utah, Arizona, and California, on the 14th. On the 15th, this cold wave extended from the lake region westward to the Pacific coast, and southward to the latitude of northern Texas, and was attended by the marked changes in tempera-

ture of the month in the southern and eastern sections of the United States. On the morning of the 15th, the barometer had risen to 30.8 in Montana, and the temperature ranged from —4° to —26°; the temperature at Fort Garry, Manitoba, being —33°. The course of this area was southward from Montana, and, by the morning of the 16th, the region of greatest pressure, 30.6, covered the southwestern part of Texas, where the temperature was below freezing. A norther occurred in the Gulf of Mexico on this date, and the frost warnings communicated by this office to the Gulf stations, the sugar regions of Louisiana, and the fruit regions of Florida, were fully verified by the occurrence of freezing weather as far southward as central Florida, They were published in the local papers, communicated direct to telegraph operators in the threatened regions, and the observer at New Orleans reports that they were worth thousands of dollars to the sugar interest of that state. On the morning of the 17th, killing frosts occurred at Port Eads, Louisiana; Galveston, Texas; and Jacksonville and Cedar Keys, Florida. After reaching the lower Rio Grande valley, this area advanced to the eastward over the Gulf of Mexico, attended by clear weather, and north to west winds at the land stations. The course of the centre was south of the coast, and the winds were from the land, thus causing more intense cold at stations near the coast.

V.—This appeared north of the lake region on the 18th, when iv. was passing to the east of Florida. This area extended over the Atlantic coast districts, attended by clear cold weather and frosts, as far south as Georgia on the 19th, when the greatest pressures, ranging from 30.52 to 30.56, were reported in the Saint Lawrence valley. The barometer rose in the districts northeast of New England on the 19th, but the general movement was to the eastward until the morning of the 21st, when the advance of the depression from the lake region caused a gradual fall of the barometer in that region. Reports from the coast stations indicate that this area disappeared in the region above named, and that it did not move eastward over the Atlantic.

VI.—The barometer was 0.2 above the normal on the 22d, and high in the southern plateau region, where the pressure continued high until this area, reinforced by a flow of cold air from the northern Rocky mountain regions on the 23d, was transferred to the upper Missouri valley. At midnight of the 23d, this area extended southwestward to California, Utah, and Arizona, while the barometer was below the normal on the north Pacific coast, and the low-area was forming in Texas. During the 24th, it extended over the northwest and southward to Texas, while a slight depression in the southwest extended northward over Missouri and Iowa, causing light snow north of the Missouri river and rain south of this region. The easterly movement of this area was apparently retarded by the development of the low-area above referred to, and by an increase of pressure from the north Pacific coast united with high-area vi., which, on the 25th, extended from the Saint Lawrence valley to the Pacific, the barometer being above 30.5 in the western districts. The morning report of the 27th placed the centre of this area in Dakota, and the charts show that the entire country from the Atlantic to the Pacific was within its limits. North to west winds prevailed east of the Rocky mountains; light snows were reported from northern Texas to New England, and freezing weather as far south as Mexico. It was well defined on the eastern slope of the Rocky mountains, and thence moved first slightly to the south and then directly eastward over the Ohio valley and the middle Atlantic states, where it became less defined, and apparently gave way to the north of low-area x., which passed northeastward along the south Atlantic coast on the 30th.

VII.—When the preceding area moved to the eastward of the Mississippi river the barometer remained high in the upper Missouri valley, and, on the 30th, the pressure had increased to 30.8 in Dakota and Montana, with the temperature below zero and light snow. The barometric gradient was rapid in a southwesterly direction, and there were indications of the development of a low-area in Arizona. During the 31st, this area moved southward over the region between the Mississippi river and the Rocky mountains, causing freezing weather as far south as San Antonio, Texas. Frosts occurred along the Atlantic coast and in northern Florida, warnings of which had been previously furnished by this office. At the close of the month, this area was inclosed in the region southwest of the lower Missouri valley by an isobar of 30.5, while there was a second area of high-pressure apparently forming in the upper Missouri valley.

AREAS OF LOW-PRESSURE.

Ten areas of low barometer have been traced within the limits of the United States during the month of December, 1882. Chart i. exhibits the paths of the centres of these barometric depressions as determined from tri-daily weather reports of this service. From the following table will be found the latitude and longitude in which each depression was first and last observed, and the average hourly velocity of each depression while within the limits of the stations of observations:

Areas of low barometer.	First Observed.		Last Observed.		Average velocity in miles per hour.
	Lat. N.	Long. W.	Lat. N.	Long. W.	
	° ′	° ′	° ′	°	
No. I.	42 30	91 00	46 00	62 00	34.
II.	50 00	110 00	48 30	77 00	28.7
III.	35 30	97 00	52 00	63 00	48.
IV.	48 00	81 00	50 00	60 00	31.
V.	42 00	98 00	43 00	62 00	27.3
VI.	48 30	124 30	48 00	63 00	26.5
VII.	30 00	97 00	45 00	86 00	22.
	35 00	98 00			
VIII.	27 00	97 00	44 00	63 00	33.5
IX.	37 00	95 00	41 00	83 00	18.5
X.	27 30	93 30	35 00	74 30	33.
Mean hourly velocity					30.2

The following table shows the number of areas of low barometer traced during the month of December, since 1873:

Month.	Year.	Number.	Month.	Year.	Number.
December	1873	12	December	1878	8
Do.	1874	12	Do.	1879	21
Do.	1875	9	Do.	1880	15
Do.	1876	15	Do.	1881	10
Do.	1877	15	Do.	1882	10

I.—On the morning of the 1st of December, a barometric depression extended over the Saint Lawrence valley from east to west, and the barometric gradient, while it was slight, showed a very gradual increase of pressure as far westward as Nevada. The afternoon report of the 1st, indicated the development of a second storm-area to the west of the lake region, although the pressure was lowest at stations northeast of New England. At the midnight report of the 1st, it exhibited an elliptical area of low-pressure extending from Ontario to Iowa, and central near Chicago. At the morning report of the 2d, the isobar of 29.9 inclosed the lower lake region. The storm increased in energy as it approached the Atlantic coast, and was attended by snow in the northern districts, after the wind shifted to the northwest. When the centre reached the coast, the course changed to the northeast, following the coastline toward Halifax, where the storm was central on the morning of the 3d. The barometer fell as this storm moved to the east, and, when last observed, the barometer was about one-half an inch lower than it was when this cyclonic movement of wind was first noted in the upper Mississippi valley. As the storm approached the Atlantic coast, cautionary off-shore signals were displayed on the middle Atlantic and New England coasts, cautionary northwest signals on the upper lakes, and cautionary signals on the lower lakes and North Carolina coast. This storm was not severe in the lake region, but it developed great energy as it approached the coast. The following maximum wind velocities were reported: Delaware Breakwater, 52 nw.; Cape Henry, 48 nw.; Kittyhawk, 46 ne.; Boston, 28 nw.; Eastport, 32 nw.

II.—This depression was first observed in British America, north of Montana on the 2d, while the barometer was high on the north Pacific coast and in the Mississippi valley. It moved directly east to Manitoba, attended by snow at northwestern stations. Its course changed to southeast on the afternoon of the 3d, and, during the night of the 3d, the centre of disturbance passed south of Lake Superior, causing southeast and southwest gales on Lakes Michigan and Huron. On the morning of the 4th, this storm extended over the entire lake region, the centre being near Escanaba, where the barometer had fallen 29.40, accompanied by brisk easterly winds and snow. At the same reports, the observer at Duluth reported barometer 29.54, wind 27, nw.; at Milwaukee, the observer reported, barometer 29.55, wind 20, sw.; at Mackinac City, 29.67, wind 28, s. The barometric gradient was decided both to the east and south, and the energy increased during the 4th, as the course changed to the north of east. This change of direction carried the centre of disturbance north of the lower lake region, but the storm extended southward to the Ohio valley and the middle states. After passing to the east of Lake Superior, the pressure increased two-tenths of an inch at the centre, during twenty-four hours, and by the morning of the 5th, it had passed north of the stations in the Saint Lawrence valley. Signals were displayed at lake stations, and at stations on the Atlantic coast between Norfolk and Portland, and were generally justified, but the greatest danger to shipping occurred in the upper lake region on the 4th, while this disturbance attained its maximum energy.

III.—When the storm last described was central north of Lake Huron, the barometric depression, then extending over the southwest, became inclosed by an isobar of 29.9, and developed energy by the advance of a cold wave from the mountain regions toward the south. This storm passed rapidly to the northeast, with increasing force and falling barometer at the centre at each succeeding report, until it reached Lake Ontario. The area of precipitation attending this storm included all districts east of the Mississippi, and the cold wave, which followed immediately in the northwest, extended the region of snow westward to the Rocky mountains. This storm passed to the north of the Gulf of Saint Lawrence on the 6th, but was followed by the development of a low-area in the western part of Canada.

IV.—This area apparently formed a part of iii., and developed a separate area during the night of the 6th, central north of the lower lake region, while a cold wave was advancing from the northwest. The barometric gradient increased rapidly in the western quadrants of this storm, and violent northwesterly gales occurred at the lake stations, accompanied by snow and temperatures ranging from 30° above to 10° below zero. This storm moved slowly down the Saint Lawrence valley on the 7th, followed by severe weather and dangerous winds in the south and west quadrants, and disappeared to the east of Newfoundland on the 8th. Warnings were given by this office to stations on the lakes, of the approach of this northwest gale, and off-shore signals were displayed on the Atlantic coast at stations north of Fort Macon. The following velocities of wind were reported during this storm: Delaware Breakwater, 57 nw.; Cape May, 62 nw.; Kittyhawk, 48 nw.; Newport, 43 w.; Portland, Maine, 40 w.; Rochester, 42 w.; Buffalo, 45 W.; Sandusky, 44 w. Reports indicate that this storm developed northeast of the upper lake region, and its great energy was due more to the advance of the cold wave from the northwest, than to the barometric depression at the centre of disturbance.

V.—This depression developed on the middle and eastern slope of the Rocky mountains, and was an extended trough of low barometer, located between two high-areas, one of which was on the Atlantic coast, while the other extended over the north Pacific, the centre of lowest pressure being near Yankton, Dakota. This distribution of pressure continued during the 9th, but the depression increased in energy and had advanced to the upper Mississippi valley as a well-defined low-area, inclosed by isobars of 29.8 and 29.9, by midnight of that day. This storm passed directly east over the lake region during the 10th, causing rain and snow in the Southern states and snow in the northern states. During the night of the 10th, the depression formed two distinct areas, one passing to the south of New England, and the other remaining central in northern New York, on the morning of the 11th. The afternoon report of the 11th, showed that these depressions had united off the New England coast. The course then changed to the northeast, and the centre apparently passed near the coast of Nova Scotia. The pressure at the centre of this depression remained near 29.8 during its passage from the northwest to the New England coast, but after its course changed to the northeast the barometer fell to 29.35 at Halifax, at midnight of the 11th, and to 29.25 at Sydney on the morning of the 12th, when this storm was last observed, thus indicating a great increase of energy as it moved to the northeastward.

VI.—This is the only storm of the month which was first observed on the Pacific coast and traced thence over the eastern part of the United States. It was central on the north Pacific coast on the afternoon of the 10th, and passed directly east, following approximately the fiftieth parallel of latitude until it reached the longitude of Lake Superior on the 12th, when the course inclined slightly to the south until the disturbance reached the Saint Lawrence valley. On the afternoon of the 13th, when the centre was north of the lower lake region, this storm separated, forming two depressions, each of which could be located between the two succeeding reports. These depressions united on the 14th, and moved to the northeast of New England. The storm passed from the Pacific to the Atlantic coast from the 10th to the 14th, and moved eastward over the Atlantic on the same latitude in which it was first observed on the Pacific coast. It increased in energy as it passed over the lake region, the barometer falling to 29.37 when the centre was near Saugeen, Canada. Heavy gales occurred at lake stations on the 13th and on the north Atlantic on the 14th. The pressure decreased at the centre and when last observed, on the 15th, the minimum pressure of 29.18 was reported from extreme northeastern stations.

VII.—This depression formed in the southwest, where the barometer was generally below the normal for the month at the Rocky mountain stations, a second depression passing eastward over the north Pacific coast. The last has not been traced, but passed over British Columbia, and to the east of the Rocky mountains north of Dakota. On the 19th, the barometer was below the mean at all western stations, and, as is indicated by this storm-track, two depressions were noted in the western Gulf states. The succeeding reports show that these depressions united during the 20th and 21st, and passed northward over the upper lake region, the course inclining more to the north as the centre approached the higher latitudes. The greatest rainfalls of the month occurred in the lower Mississippi valley, when this storm was passing northeastward from Indian Territory. On the 20th, rain or snow occurred in all districts east of the Rocky mountains, except in New England. The barometer fell at the centre of this disturbance until it had passed the southern portion of Lake Michigan, where maximum wind velocities occurred. After passing this latitude the pressure increased slowly at the centre, and the reports indicate that the storm was losing energy when it passed beyond the limits of observation.

VIII.—This was a depression of slight energy which appeared south of Texas on the 21st, attended then and on the following day by a light norther in the southwest. It moved to the eastward over the Gulf, probably passing the coast-line near Pensacola on the 22d, after which the depression could not be defined by the usual isobars drawn for every one-tenth of an inch of pressure. This portion of the track has therefore been drawn dotted, as the general circulation of the winds and the weather conditions in the south Atlantic states indicate the presence of a slight disturbance which became quite well defined off the middle Atlantic coast at the 11.00 p. m. report of the 22d. The storm increased in energy after the above

report, and, moving in a northeasterly direction, caused severe gales near Cape Cod and off the New England coast on the 23d. The barometer fell at the northeastern stations on the 24th. The late reports show that the storm developed great energy as it passed over the Atlantic.

IX.—The weather conditions in the western Gulf states attending the development of this storm were somewhat similar to those described as accompanying storm viii. Two slight depressions appeared at midnight of the 24th, one central in southern Missouri, and the other central south of the Texas coast. These depressions united and formed that traced as ix., the barometer remaining low in the southwestern sections of the country. The depression developed but slight energy and finally disappeared in the upper Ohio valley on the 26th, in advance of a cold wave which apparently interrupted the cyclonic movement of winds and caused the formation of a second depression to the eastward of New England.

X.—This appeared in southern Florida, as a slight depression, on the 29th, forming in advance of an area of cold air which was at that time moving slowly southward over the Mississippi valley. This storm was at no time inclosed within the limits of the stations, but the changes in barometric pressure and wind directions show that it moved to the northeast nearly parallel with the Atlantic coast. Severe gales occurred at Kittyhawk, Hatteras, and Cape Henry, accompanied by very heavy rainfall. The following maximum wind velocities were reported: Kittyhawk, 66 ne.; Cape Henry, 48 n.

NORTH ATLANTIC STORMS DURING DECEMBER, 1882.

Chart supplemental to number i., exhibits the tracks of the principal storms that have prevailed over the north Atlantic ocean during December, 1882. The location of the various storm-centres has been approximately determined from reports of observations furnished by agents and captains of ocean steamships and sailing vessels in the north Atlantic, and from other miscellaneous data received at this office up to January 20th.

The observations used are, in general, simultaneous, being taken each day at 7 h. 0 m. a. m., Washington, or 12 h. 8 m. p. m., Greenwich mean time.

The following brief notes concern the storms above mentioned:

I.—This is a continuation of the storm charted as low-area i., chart i. On the morning of the 3d, the depression was central south of Nova Scotia; it moved rapidly northeastward near to the coast-line, and probably crossed the southern extremity of Newfoundland. On the 4th, it was central near the Banks, attended by severe gales on the coast of Newfoundland. On the 5th, the storm-centre was apparently near W. 35°, and between N. 50° and 55°; on that date, the s. s. "British Crown," in N. 53° 35′, W. 35° 42′, reported barometer 29.43 (747.5), wind nnw., force 8, weather squally, with rain. On the 6th, the centre of disturbance was shown near N. 50°, W. 20°, the s. s. "Wyoming," in N. 51° 13′, W. 17° 21′, reporting barometer 29.69 (754.1), wind e. by n., force 5; and the s. s. "Frisia," in N. 49° 52′, W. 22° 50′, barometer 29.69 (754.1), wind nne., force 7, squally weather. During the 6th, the disturbance moved eastward, and on the 7th, it was probably central near the British Isles. This depression appears to have moved very rapidly eastward, its average velocity of translation being about thirty-seven miles per hour; it was also closely followed by an immediate increase of pressure in its rear.

II.—This is probably a continuation of the depression traced as low-area iv., of chart i. On the 8th, the storm-centre was over the Gulf of Saint Lawrence; strong south-southeasterly gales were reported by vessels near the Banks of Newfoundland, while equally strong westerly winds were encountered near Nova Scotia. Captain W. H. P. Hains, of the s. s. "Gallia," (in about N. 41°, W. 62°), reported: 8th, at 2 h. 30 m., a. m., Greenwich mean time, violent storm, wind shifting from s. to wnw., with violent squalls, and torrents of rain; heavy thunder, vivid sheet and forked lightning; confused sea; the fury of the storm lasted about three hours, lowest barometer 29.65 (753.1). On the 9th, the depression was apparently central near N. 49°, W. 42°; the s. s. "Frisia," in N. 46° 52′, W. 42° 55′, reported barometer 29.87 (758.7), a fall of .33 inch, wind wnw., force 6–8, cloudy and rainy weather; the s. s. "Gellert," in N. 49° 36′, W. 33° 15′, barometer 29.92 (760.0), wind ese., force 6, cloudy. During the day, the disturbance apparently moved in a northeasterly direction, and on the morning of the 10th, was central near N. 51°, W. 35°; on that date, the s. s. "Colima," in N. 53° 17′, W. 31° 53′, reported barometer 29.68 (753.9), a fall of .26 inch in twenty-four hours, wind se. by s., force 5, sleeting; s. s. "Arizona," in N. 50° 54′, W. 35° 14′, barometer 29.83 (757.7), wind variable, weather overcast and cloudy. On the 11th, the depression appears to have moved in a course slightly to the south of east, the region of least pressure, on that day, being apparently south of N. 50°, and near W. 25°; the s. s. "Arizona," in N. 51° 10′, W. 24° 56′, reported barometer 29.72 (754.9), wind e., force 4, overcast; and the s. s. "Nederland," in N. 49° 52′, W. 21° 32′, barometer 29.82 (757.4), wind ne., force 6, drizzling. Strong westerly and northwesterly gales were reported by vessels south and west of the centre of disturbance; the ship "E. J. Spicer," in N. 45° 32′, W. 29° 40′, reporting barometer 29.83 (756.7), wind w., force 8, squally. On the morning of the 12th, the depression was central, with decreased pressure near the entrance to the English Channel, and moderate northerly and northeasterly gales prevailed over that region. The s. s. "Arizona," in N. 51° 32′, W. 15° 58′, reported barometer 29.59 (751.6), wind n., force 3; s. s. "Gellert," in N. 50° 05′, W. 10° 00′, barometer 29.50 (749.3), wind ne., force 6, squally; s. s. "Switzerland," in N. 50° 47′, W. 16° 39′, barometer 29.64 (752.8) wind n. by e., force 5.

III.—This is a continuation of the depression traced on chart i. as low-area v. During the 11th, the disturbance passed off the New England coast into the Atlantic attended by strong westerly and southwesterly winds near the coast. On the morning of the 12th, the depression was apparently central south of Newfoundland; on that day the atmospheric pressure greatly decreased and the barometer fell to 28.90 (734.0). From reports at hand, it would appear that this was the most severe storm of the month; several vessels were wrecked, involving serious loss of life, on the coasts of Newfoundland and Nova Scotia, and much property was destroyed in the harbors. During this gale, the Inman steamship "City of Berlin" lost her rudder and rudder-post, and returned to New York in tow of the s. s. "City of Chester." The s. s. "City of Berlin," in N. 43°, W. 57°, reported: On the 12th, had a severe gale from sw., barometer fell to 28.93 (734.8), at 6 a. m., after which time it began to rise; at 7 a. m. the reading was 29.01 (736.8), wind w., force 9, sleet and misty; the sea was very high and dangerous and the vessel was hove to. The s. s. "Nova Scotian," in N. 47° 52′, W. 50° 15′, reported barometer 29.11 (739.4), wind se., force 4, raining; the s. s. "Celtic," in N. 44° 58′, W. 52° 44′, reported barometer 29.13 (739.9), wind wsw., force 8, cloudy; all vessels between N. 40° and 45° and west of the fiftieth meridian encountered westerly and northwesterly winds of force 7 to 10. Captain Hebich, of the s. s. "Wieland," reported as follows: "During the 10th and 11th, had moderate breeze and sea. On the 12th, (N. 46° 21′, W. 46° 57′), the wind increased to a gale, with very high, wild, and cross-running sea; the gale began at ese., and shifted during the forenoon to s. During the night of the 12th–13th, the wind shifted to sw., with heavy rain; the ship took breakers fore and aft, and the deck was covered with water, At the beginning of the gale, the barometer read 30.01 (762.2), and gradually fell to 29.13 (739.9), on the night of December 12th." During the 12th, the disturbance moved northeastward, and on the 13th, the storm-centre was apparently near N. 50°, W. 45°. The s. s. "Nova Scotian," in N. 50° 27′, W. 45° 15′, reported barometer 28.41 (721.6), wind sw. by s., force 5, high confused sea, raining; s. s. "Colima," in N. 49° 20′, W. 43°

05′, barometer 28.85 (732.8), wind wsw., force 10. On the 14th, the disturbance, having moved slowly eastward, was central near N. 51°, W. 40°; moderate winds prevailed near the centre, while strong westerly gales prevailed over the region to the westward of the fortieth meridian. The s. s. "Alaska," on the 13th and 14th, from N. 48° 14′, W. 39° 38′, to N. 47° 25′, W. 42° 38′, encountered very heavy westerly gales, with mountainous seas; during these twenty-four hours, the vessel steamed only one hundred and thirty miles. The s. s. "Nova Scotian," on the 14th, in N. 51° 53′, W. 39° 19′, reported barometer 28.84 (732.5), wind ene., force 4, showery; and the s. s. "State of Georgia," in N. 51° 01′, W. 38° 12′, barometer 28.91 (734.3), wind sse., force 1, heavy sw. sea; the s. s. "Bothnia," in N. 48° 21′, W. 39° 08′, reported barometer 29.17 (740.9), heavy westerly gale, accompanied by hail, rain, and very heavy squalls, heavy westerly sea. On the 15th, the storm-centre was near W. 30°; the pressure had slightly increased and the storm apparently diminished in energy. The s. s. "Elbe," in N. 49° 40′, W. 26° 23′, reported barometer 29.22 (742.2), wind sw., force 2, cloudy; s. s. "Werra," in N. 50° 12′, W. 30° 25′, barometer 29.39 (746.5), wind n., force 2–3. During the 15th, the disturbance moved northeastward, and on the 16th, it was central probably near the northwestern coast of Ireland. The s. s. "Ethiopia," in N. 54° 42′, W. 13° 59′, on the 16th, reported barometer 29.29 (744.0), wind ese., force 4, overcast and rainy, and the s. s. "Baltic," in N. 57° 32′, W. 14° 36′, barometer 29.33 (745.0), wind nw., force 6.

IV.—This is probably a continuation of the storm traced as low-area vi., chart i. At midnight of the 14th, the depression was central over the Gulf of Saint Lawrence, and during that day strong southeasterly gales prevailed over Newfoundland and to the south of Nova Scotia, and numerous marine disasters were reported. On the 15th, the centre of disturbance was to the eastward of Newfoundland, and probably united with the remains of low-area iii. On the 16th, the depression was central near N. 52°, W. 40°; the s. s. "Werra" in N. 48° 32′, W. 39° 00′, reported barometer, 29.25 (742.9), wind wsw., force 7–8, cloudy and rainy weather, and the s. s. "Elysia", in N. 47° 28′, W. 34° 34′, barometer 29.61 (752.1), wind sw., force 5. The depression passed northeastward, being succeeded by strong northwesterly winds and clearing weather in the western quadrants, and on the 17th, it was central near N. 54°, W. 25°; on that date, the s. s. "Nova Scotian," in N. 55° 02′, W. 20° 07′, reported barometer 29.04 (737.6), wind sse., force 3, cloudy. The s. s. "Ohio", in N. 51° 09′, W. 20° 30′, reported barometer 29.13 (739.9), wind w., force 5, fair; while vessels to the eastward of the twentieth meridian encountered strong southerly gales. On the 18th, the depression was off the Irish coast, accompanied by moderated easterly and northeasterly gales in the region north and east of the centre, while brisk northerly and northwesterly winds prevailed in the rear of the depression. From the 20th, to the close of the month, a large and deep depression covered the north Atlantic ocean from Newfoundland eastward to the British Isles. In this extended area, the atmospheric pressure ranged from 28.50 (723.9) to 29.80 (756.9), and from the circulation of winds, it would appear that two or more independent storm-centres were enclosed within its limits; the data on hand at this moment, however, are too meagre to admit of a tracing of the paths of these storms. It is worthy of note, that, notwithstanding the depth of the atmospheric depression, extremely violent winds do not appear to have been general, many vessels reporting light to moderate winds. The following reports serve to indicate the weather conditions over the north Atlantic during the last decade of the month: Captain Molsen of the s. s. "Heckla," reported: "From the 20th, to 26th, between N. 56° 30′, W. 25° 10′, and N. 45° 30′, W. 53° 00′, barometer oscillating irregularly between 29.47 (748.5) and 30.20 (767.0); wind very unsteady in direction and force; weather threatening with clearing at intervals." Captain Hamilton Perry, of the s. s. "Britannic," reported: "December 23d, in N. 51° 21′, W. 14° 22′, light westerly breeze with heavy rain, barometer 29.98 (761.5) moderate sea from wsw., barometer falling slowly but steadily until 4 a. m., of the 26th, (about N. 49° 24′, W. 38° 15′), when it read 28.85 (732.8). During this interval, the wind had been variable in direction, and from strong to gentle breeze with heavy swell from the sw. After the 26th, the barometer rose steadily, the wind veered to ne. and n., with heavy squalls and showers of rain, and with heavy northeasterly swell. At no time did we have the wind to warrant such a low glass."

Captain J. T. Rogers, of the s. s. "Lepanto," reported: "December 20th, 2.30 p. m. (near N. 44°, W. 37°), strong southerly gale with hard squalls of rain; dull cloudy weather and high mountainous sea; moderating at midnight of 20th. 21st, moderate southeasterly gale, much rain and very heavy swell from south; weather at times clearing, and then heavy squalls of rain would appear on the horizon. This fitful weather continued until the morning of the 22d; at 8.40 a. m., Greenwich mean time, it became overcast, the wind increased and lulled until 9.40 a. m., when it blew a hurricane, accompanied by heavy rain. At 4.00 a. m., the barometer read 29.76 (755.9), and at 8.40 a. m., it stood at 29.07 (738.4); the hurricane lasted two hours, and then decreased to a very strong gale. On the 25th, at 8.00 a. m. (N. 42°, W. 54°), had a strong northwesterly gale and high sea; terrific squalls of wind and rain till noon of the 26th, when it moderated."

Captain W. C. Gardner, of the bark "Champion," reports: "23d, 3.30 p. m., Greenwich mean time, N. 32° 05′, W. 74° 07′, with lowering overcast sky, it began to rain heavily, accompanied by thunder and lightning, wind falling light. The electrical disturbance continued until 6.30 p. m., when it ceased, the rain continuing (but lighter) until 10.00 p. m., wind, light airs."

Captain Brooks, of the s. s. "Arizona," reports: "26th, (N. 51° 07′, W. 27° 29′), at 5.50 p. m., Greenwich mean time, the barometer fell to 28.70 (729.0), wind wsw., force 10 to 12, with constant rain; the barometer then rose slowly, and the wind gradually decreased. This gale ended at wsw. We nearly always find gales of this nature shifting suddenly to the northward."

Captain H. C. Williams, of the s. s. "Brooklyn," reports: "25th, at 21h. 29m. (near N. 52°, W. 33°), lowest reading of the barometer 28.50 (723.9); depression evidently very extensive, and the gradient of a moderate inclination, as it passed without any atmospheric disturbance corresponding with the low state of the barometer."

Captain E. E. Wilson, of the s. s. "Salerno," reported: "From 29th to 31st, between N. 49°, W. 17°, and N. 49°, W. 27°, barometer rising gradually until 8.00 p. m. of the 29th, when it fell to 29.10 (739.1), wind backed to southeast, blowing strongly, with fine clear weather and heavy cross-sea, which continued until 4.00 a. m. of the 30th. The wind then shifted to westerly, and continued to blow hard; weather clear. At 6.00 a. m. of the 31st, the barometer again fell to 29.27 (743.4), weather cloudy with rain, fresh breeze from e., sw., w., and nw.

INTERNATIONAL METEOROLOGY.

International charts iv. and v. accompany the present number of this REVIEW. Chart iv. is published for October, 1880, and continues the series begun in January, 1877. Chart v. is prepared for January, 1881, and continues the series begun in November, 1877. For the description of these charts, much valuable information has been obtained from the "Monatliche Uebersicht der Witterung," published by Professor Dr. G. Neumayer, Director of the German Marine Observatory at Hamburg, and from the "Bulletin Mensuel," published by Mr. Marc Dechrevens, of Zi-Ka-Wei, China.

Chart iv. exhibits the mean pressure, mean temperature, and the prevailing directions of the wind over the northern hemisphere, and at certain isolated stations in the southern hemisphere, as determined from one observation taken each day at 7.35 a. m. Washington, or 0.43 p. m. Greenwich mean time.

The region of lowest mean pressure, indicated by the isobar of 29.60 (751.8), occupied that part of European Russia lying